fibres of neighboring cells are continuous; as, indeed, recent studies in the continuity of protoplasm seem to show. The entire idioplasm of the body is then one immense *reticulum*, and a higher organism is thus related to the outside world as a cell on a larger scale. Any disturbance of the idioplasm at one point is transmitted to distant points. Thus the idioplasm preserves a uniform structure so that all cross sections are similar. But the fibre itself is supposed to be composed of rows of units termed *micellae*. The micellae are alike in a single row, and grow and reproduce in a longitudinal direction only. But different rows are unlike; and the peculiar characteristics of an organism depend on the particular structure which a cross section represents. Furthermore, not all the micellae of the cross section are active at once, but certain layers of them act, and in turn stimulate more internal or external layers to activity, and in this way the orderly succession of the cyclic development of ontogeny may be accounted for. All this has been upset by recent discoveries concerning the cell nucleus. In sexual reproduction the characters of the father appear equally transmitted with those of the mother. These characters are therefore contained in the spermatozoon.

Beiträge zur Kenntniss der Bildung, Befruchtung und Theilung des thierischen Eies. O. HERTWIG. Leipzig, 1876.

Hertwig has shown that the union of sperm cell and egg cell known as fertilization or fecundation, consists essentially in the fusion of two similar nuclei (male and female pronuclei), sometimes the tail of the spermatozoon not even entering the egg. Studies of the production of the spermatozoon *(spermatogenesis)* show that cells (quite similar to those that in the female reproductive organs become ova by growth) in the male reproductive organs after repeated divisions become spermatozoa by direct transformation of the cell protoplasm to serve locomotive purposes, the nucleus remaining in the "head" of the spermatozoon. Kölliker, however, derives the entire body of the spermatozoon from the nucleus. It is certain that a large part of the cell protoplasm is lost, and only that immediately surrounding the nucleus is utilized in the maturation of the male element in the highest animals.

Neue Untersuchungen über den Befruchtungsvorgang bei den Phanerogamen als Grundlage für eine Theorie der Zeugung. STRASBURGER. Jena, 1884.

This observer has shown that in the tube of the pollen grain, when it has sprouted upon the stigma of a flower, a nucleus ("generative nucleus") wanders down and seeks the nucleus of the germ cell of the ovary.

Gruber, and others in studying the sexual unions of the unicellular animals, have shown that there is a dividing up of the nucleus, and in *reciprocal fertilization (conjugation*, or copulation of *ciliata)*, there is a mutual interchange of nuclear material; while in *zygotic fertilization* (similar to the union of ovum and spermatozoon) there is a union of the nuclei to form one nucleus.

Bericht der Naturforchenden Gesellschaft zu Freiburg. Vol. 1, 1886. GRUBER.

Gruber has found that by cutting up stentors, the fragments became regenerated to complete stentors whenever a portion of the nucleus was retained in the segment cut off. This experiment proved definitely that the power of assimilation rests with the nucleus, or at least the nucleus has a necessary control. We may also conclude that the nucleus is not a definite structure like the idioplasm of Nägeli, but is an aggregation of gemmules that are alike; each of which can reproduce itself *ad lib-*

itum, and in each of which, therefore, the hereditary characters rest. *The idioplasmic structure, then, is to be sought for in the structure of the nuclear gemmule.* The above conclusions are much in harmony with many facts observed with reference to cells. Let us more especially recall the complicated phenomena of *Karyokinesis*, or indirect cell-division, in which we see the nuclear granules and microsomata pass through complex evolutions of divisions and conjugations, and, finally separate into two groups so as to give to each daughter cell a similar structure. This is especially seen in the division of tissue cells; and Strasburger and others have supposed that *direct division* results in dissimilar cells, *Karyokinetic*, the reverse. But if we believe the different characters of cells in ontogenetic differentiation are due to a separation of gemmules into corresponding differentiated groups, we should naturally suppose the more complicated process to take place in the latter case. See ROUX: *Bedeutung der Kerntheilungsfiguren.* Leipzig, 1883.

Significance of sex. NELSON. See abstract, this JOURNAL, Vol. I, p. 543.

Nelson has given a different explanation, referring the phenomena to sexual processes. According to this view all reproduction is sexual, but accompanied by different degrees of inbreeding or crossing,—the gemmules being looked upon as descendants of a common ancestor just as are the protozoa that conjugate.

We are now prepared to review the Pangenesis theory of Darwin. *(Origin of Species.)* The germ cells are looked upon as storehouses of gemmules that have come from all the cells of the body. Each sort of cell is supposed to have its special sort of gemmule, and these can indefinitely multiply their kind, and thus build up a cell, but at the same time there tends to be variation in their characters, not in a definite direction nor in response to definite stimuli, but often, of course, through the action of the environment when this is out of adaptation to the animal.

Ontogenetic development is explained as the successive activity of gemmules of the ancestors, which are all represented in the germ cells. Cell-division, resulting in differentiated cells, is accompanied by a conjugation of the gemmules of the next succeeding stage with the gemmules that have developed into the cell protoplasm or are active in the preceding stage. The weak point of the theory lies here. It does not show how the characters of the gemmules, nor how the conjugation of the gemmules, effect the evolution of the so differentiated cells. We should also expect, if the cells are giving off gemmules, that inoculation with the blood of a different animal would be the equivalent of a crossing or fertilization, but Galton's experiments in this direction gave negative results. These experiments, it seems to us, have too hastily been taken to disprove the theory; they appear to give negative proof only. Another objection to the theory has been, that the number of gemmules that must be gathered in an egg must in the higher animals be practically so great as to be unthinkable.

The Law of Heredity. W. K. BROOKS. Baltimore, 1883.

To reduce the number of gemmules needed was the aim of Brooks. If it were not for the fact of variation we could get along with a few gemmules, for then we need not gather up the gemmules from the body, because the germ cells of the offspring are the descendants of the egg of the parent, (true of all tissue cells) and of course have the structure of the ancestral germ cell. If now we suppose that gemmules are given off by cells only when a special stimulus is received, as (e. g., when the environment calls for better adaptation) then these gemmules will vary from their like in the egg and will hybridize the latter, and thus produce